

### **ABSTRACT OF THE DISCLOSURE**

A plasma generator for space charge neutralization of an ion beam is disclosed and resides within an ion implantation system operable to generate an ion beam and direct the ion beam along a beamline path. The plasma generator comprises an electric field generation system operable to generate an electric field in a portion of the beamline path, and a magnetic field generation system operable to generate a magnetic field in the portion of the beamline path, wherein the magnetic field is perpendicular to the electric field. The plasma generator further comprises a gas source operable to introduce a gas in a region occupied by the electric field and the magnetic field. Electrons in the region move in the region due to the electric field and the magnetic field, respectively, and at least some of the electrons collide with the gas in the region to ionize a portion of the gas, thereby generating a plasma in the region.